

N- and P-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY				
	V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
N-Channel	60	0.025 at V _{GS} = 10 V	22	23
		0.029 at V _{GS} = 4.5 V	20	
P-Channel	- 60	0.041 at V _{GS} = - 10 V	- 19	42
		0.053 at V _{GS} = - 4.5 V	- 16	

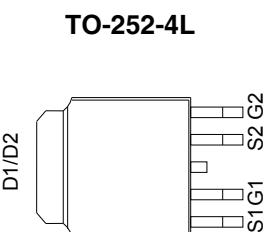
FEATURES

- DT-Trench Power MOSFET
- 100 % R_g and UIS Tested

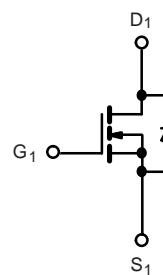


APPLICATIONS

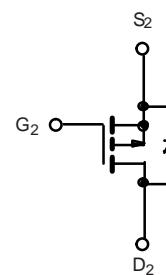
- Inverter



TO-252-4L



N-Channel MOSFET



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted				
Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V _{DS}	60	- 60	V
Gate-Source Voltage	V _{GS}	± 20	± 20	
Continuous Drain Current (T _J = 150 °C)	T _C = 25 °C	22	- 19	
	T _C = 70 °C	20	- 15	
	T _A = 25 °C	8.0 ^{b, c}	- 7.2 ^{b, c}	
	T _A = 70 °C	6.2 ^{b, c}	- 5.8 ^{b, c}	
Pulsed Drain Current (10 µs Pulse Width)	I _{DM}	88	- 76	A
Source-Drain Current Diode Current	T _C = 25 °C	22	- 19	
	T _A = 25 °C	18 ^{b, c}	- 16 ^{b, c}	
Pulsed Source-Drain Current	I _{SM}	88	- 76	
Single Pulse Avalanche Current	I _{AS}	20	- 18	
Single Pulse Avalanche Energy	E _{AS}	35	57	mJ
Maximum Power Dissipation	T _C = 25 °C	56	69	
	T _C = 70 °C	32	52	
	T _A = 25 °C	9 ^{b, c}	8 ^{b, c}	
	T _A = 70 °C	7.28 ^{b, c}	6.59 ^{b, c}	
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 150		
		°C		

THERMAL RESISTANCE RATINGS						
Parameter	Symbol	N-Channel		P-Channel		Unit
		Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient ^{b, d}	t ≤ 10 s	R _{thJA}	19	25	20	30
Maximum Junction-to-Foot (Drain)	Steady State	R _{thJF}	40	50	40	50

Notes:

- Based on T_C = 25 °C.
- Surface Mounted on 1" x 1" FR4 board.
- t = 10 s.
- Maximum under Steady State conditions is 120 °C/W (N-Channel) and 110 °C/W (P-Channel).

SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	N-Ch	60		V
		$V_{GS} = 0 \text{ V}, I_D = -250 \mu\text{A}$	P-Ch	- 60		
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250 \mu\text{A}$	N-Ch	40		mV/ $^\circ\text{C}$
		$I_D = -250 \mu\text{A}$	P-Ch	- 40		
$V_{GS(\text{th})}$ Temperature Coefficient	$\Delta V_{GS(\text{th})}/T_J$	$I_D = 250 \mu\text{A}$	N-Ch	- 4.1		
		$I_D = -250 \mu\text{A}$	P-Ch	5.0		
Gate Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	N-Ch	1.0	3.0	V
		$V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$	P-Ch	- 1.0	- 3.0	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$	N-Ch		± 100	nA
		$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$	P-Ch		± 100	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}$	N-Ch		1	μA
		$V_{DS} = -48 \text{ V}, V_{GS} = 0 \text{ V}$	P-Ch		- 1	
		$V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$	N-Ch		10	
		$V_{DS} = -48 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$	P-Ch		- 10	
On-State Drain Current ^b	$I_{D(\text{on})}$	$V_{DS} = 5 \text{ V}, V_{GS} = 10 \text{ V}$	N-Ch	22		A
		$V_{DS} = -5 \text{ V}, V_{GS} = -10 \text{ V}$	P-Ch	- 19		
Drain-Source On-State Resistance ^b	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}, I_D = 8 \text{ A}$	N-Ch	0.025	0.030	Ω
		$V_{GS} = -10 \text{ V}, I_D = -8 \text{ A}$	P-Ch	0.041	0.051	
		$V_{GS} = 4.5 \text{ V}, I_D = 5 \text{ A}$	N-Ch	0.029	0.038	
		$V_{GS} = -4.5 \text{ V}, I_D = -5 \text{ A}$	P-Ch	0.053	0.065	
Forward Transconductance ^b	g_{fs}	$V_{DS} = 15 \text{ V}, I_D = 8 \text{ A}$	N-Ch	27		S
		$V_{DS} = -15 \text{ V}, I_D = -8 \text{ A}$	P-Ch	25		
Dynamic^a						
Input Capacitance	C_{iss}	N-Channel $V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	N-Ch		755	pF
			P-Ch		1050	
Output Capacitance	C_{oss}	P-Channel $V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	N-Ch		120	
			P-Ch		240	
Reverse Transfer Capacitance	C_{rss}		N-Ch		48	
			P-Ch		221	
Total Gate Charge	Q_g	$V_{DS} = 48 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 10 \text{ A}$	N-Ch		23	nC
		$V_{DS} = -48 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -10 \text{ A}$	P-Ch		42	
Gate-Source Charge	Q_{gs}	N-Channel $V_{DS} = 48 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 10 \text{ A}$	N-Ch		16	
			P-Ch		21.7	
Gate-Drain Charge	Q_{gd}	P-Channel $V_{DS} = -48 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -10 \text{ A}$	N-Ch		2.6	
			P-Ch		5.6	
Gate Resistance	R_g	$f = 1 \text{ MHz}$	N-Ch	0.3	1.5	3.0
			P-Ch	1.3	6.4	
						Ω

SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted

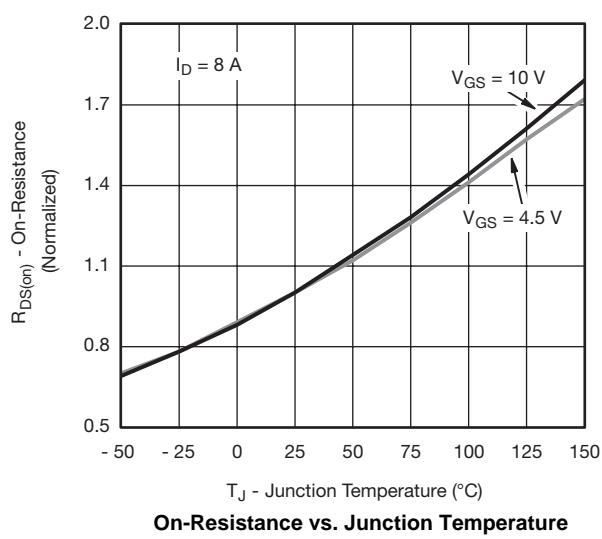
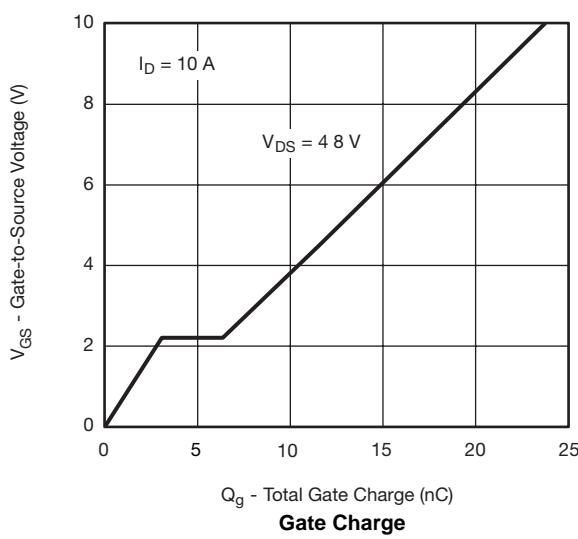
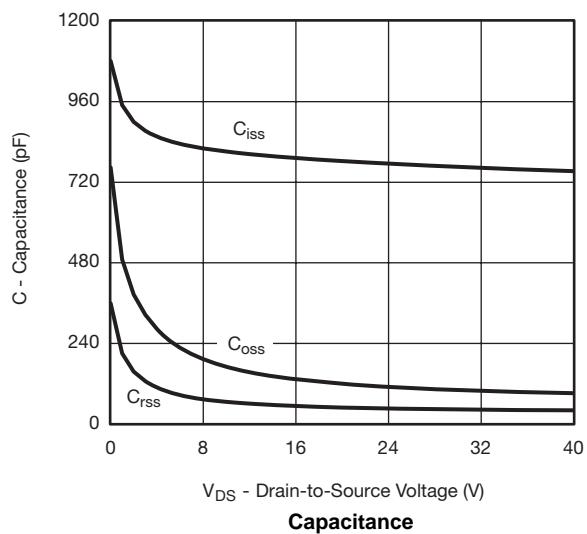
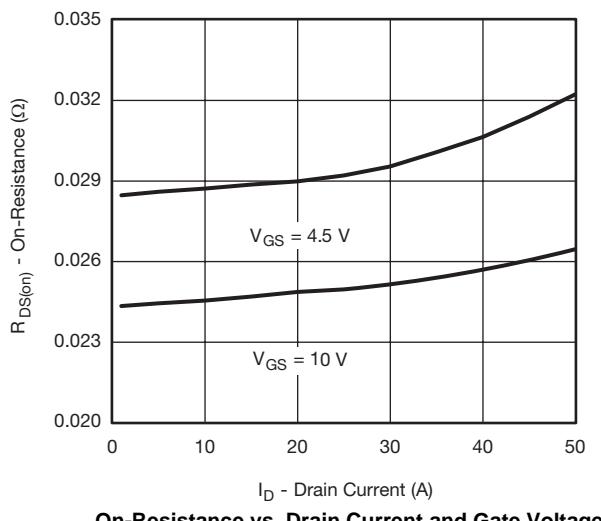
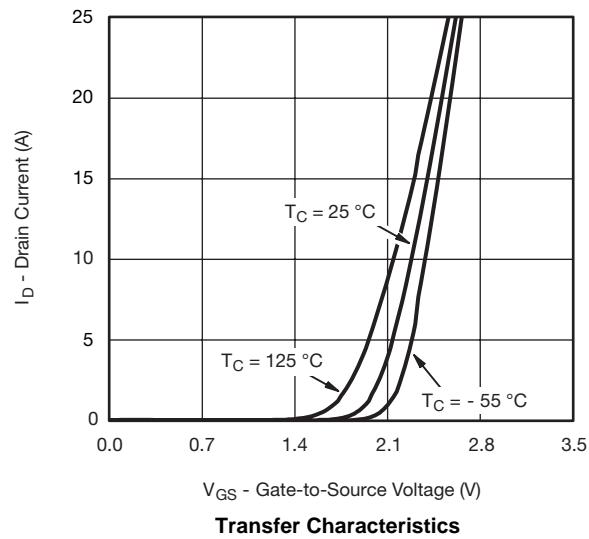
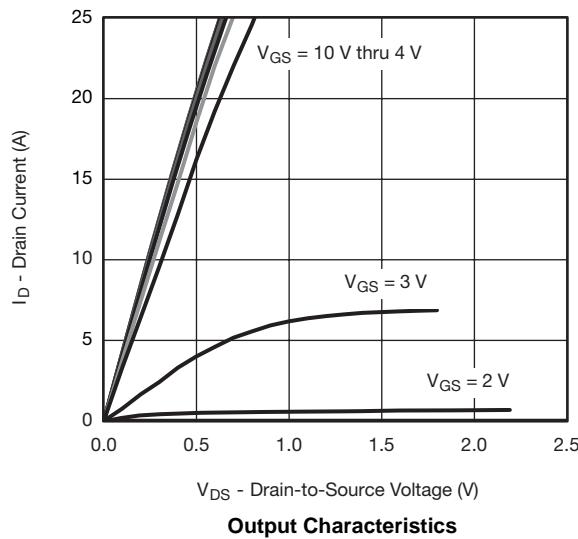
Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit
Dynamic^a						
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 48 \text{ V}, R_L = 2 \Omega$ $I_D \geq 10 \text{ A}, V_{GEN} = 10 \text{ V}, R_g = 1 \Omega$ P-Channel $V_{DD} = -48 \text{ V}, R_L = 2 \Omega$ $I_D \leq -10 \text{ A}, V_{GEN} = -10 \text{ V}, R_g = 1 \Omega$	N-Ch	7	14	ns
Rise Time	t_r		P-Ch	9	18	
Turn-Off Delay Time	$t_{d(off)}$		N-Ch	10	20	
Fall Time	t_f		P-Ch	9	18	
Turn-On Delay Time	$t_{d(on)}$		N-Ch	18	36	
Rise Time	t_r		P-Ch	50	90	
Turn-Off Delay Time	$t_{d(off)}$		N-Ch	9	18	
Fall Time	t_f		P-Ch	14	28	
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$ N-Channel $V_{DD} = 48 \text{ V}, R_L = 2 \Omega$ $I_D \geq 10 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_g = 1 \Omega$ P-Channel $V_{DD} = -48 \text{ V}, R_L = 2 \Omega$ $I_D \leq -10 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_g = 1 \Omega$	N-Ch	11	22	A
Pulse Diode Forward Current ^a	I_{SM}		P-Ch	42	75	
Body Diode Voltage	V_{SD}		N-Ch	15	30	
Body Diode Reverse Recovery Time	t_{rr}		P-Ch	40	70	
Body Diode Reverse Recovery Charge	Q_{rr}		N-Ch	23	46	
Reverse Recovery Fall Time	t_a		P-Ch	40	70	
Reverse Recovery Rise Time	t_b		N-Ch	13	26	
			P-Ch	15	30	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$ N-Channel $I_F = 5 \text{ A}, dI/dt = 100 \text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$ P-Channel $I_F = -5 \text{ A}, dI/dt = -100 \text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$	N-Ch		22	ns
Pulse Diode Forward Current ^a	I_{SM}		P-Ch		-19	
Body Diode Voltage	V_{SD}		N-Ch		88	
Body Diode Reverse Recovery Time	t_{rr}		P-Ch		-76	
Body Diode Reverse Recovery Charge	Q_{rr}		N-Ch	0.7	1.2	V
Reverse Recovery Fall Time	t_a		P-Ch	-0.7	-1.2	
Reverse Recovery Rise Time	t_b		N-Ch	17	34	
			P-Ch	30	60	
			N-Ch	10	20	nC
			P-Ch	26	52	
			N-Ch	10		ns
			P-Ch	15		
			N-Ch	7		
			P-Ch	15		

Notes:

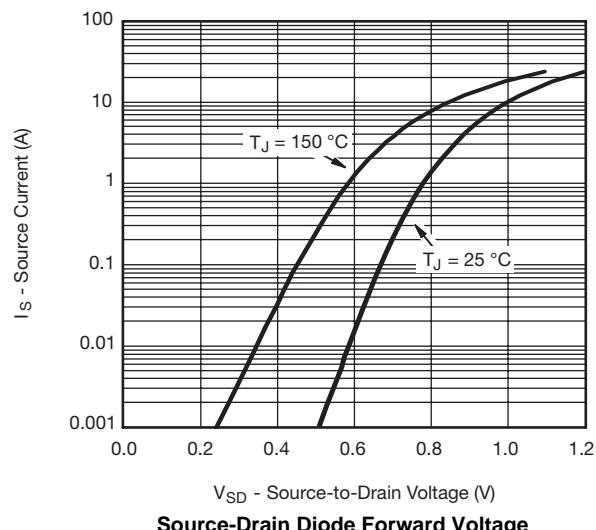
- a. Guaranteed by design, not subject to production testing.
- b. Pulse test; pulse width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

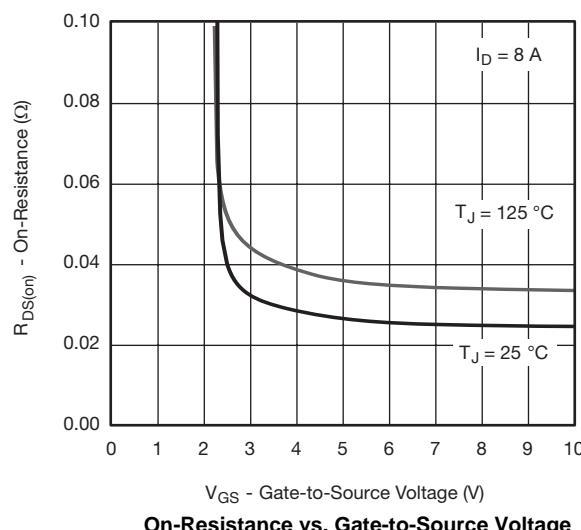
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



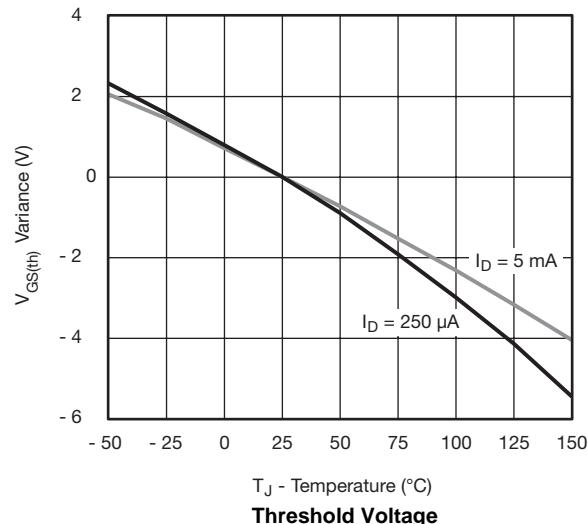
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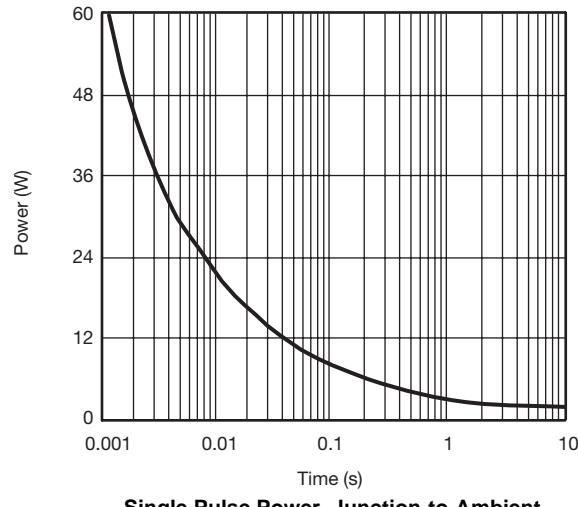
Source-Drain Diode Forward Voltage



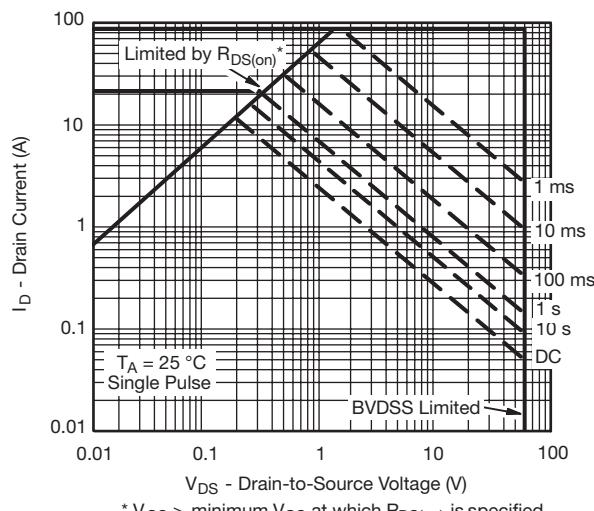
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

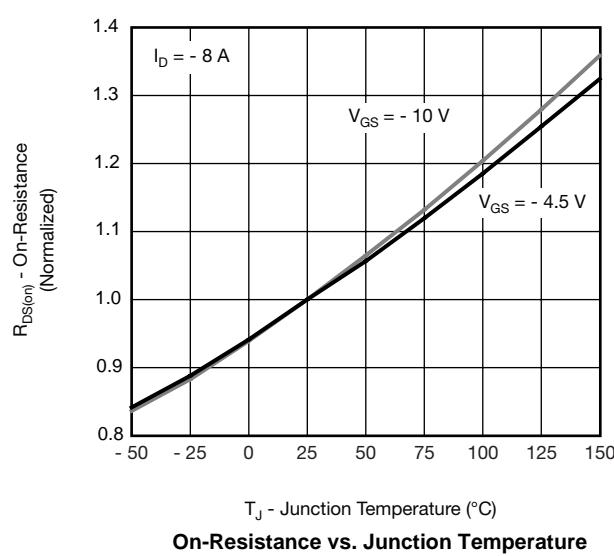
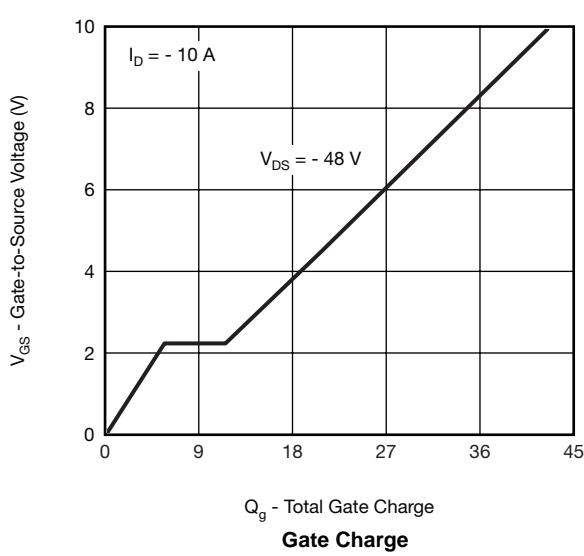
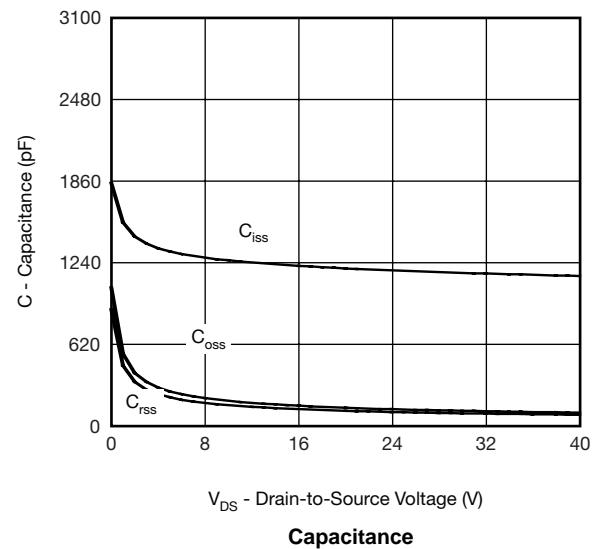
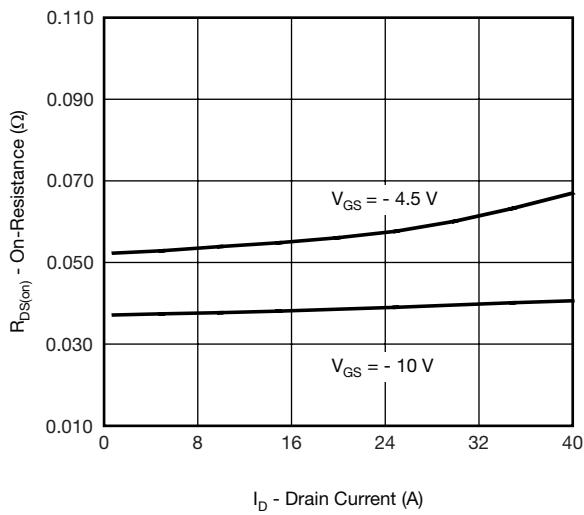
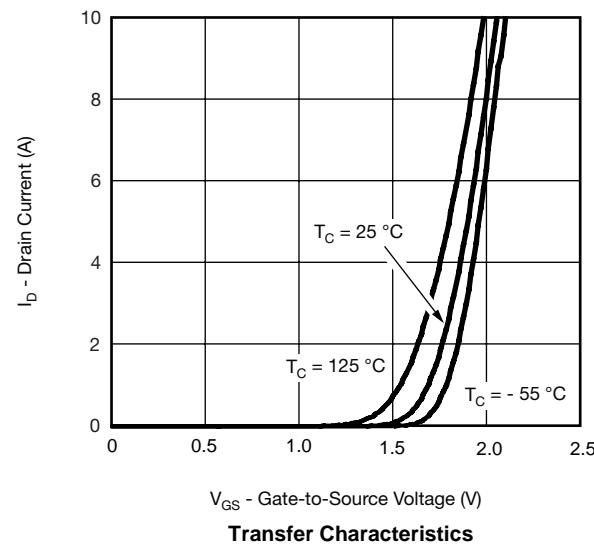
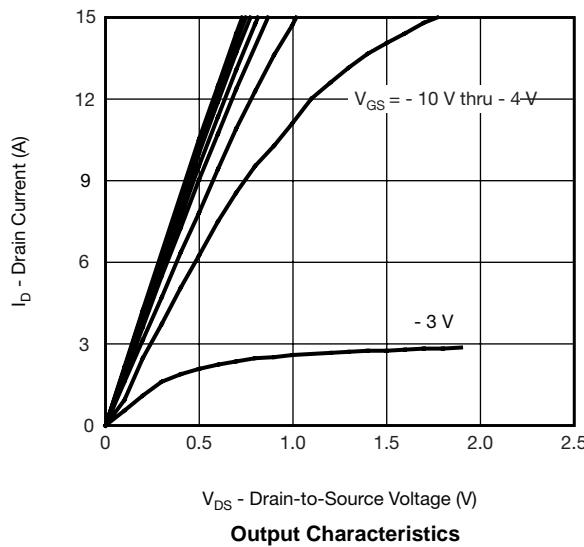


Single Pulse Power, Junction-to-Ambient

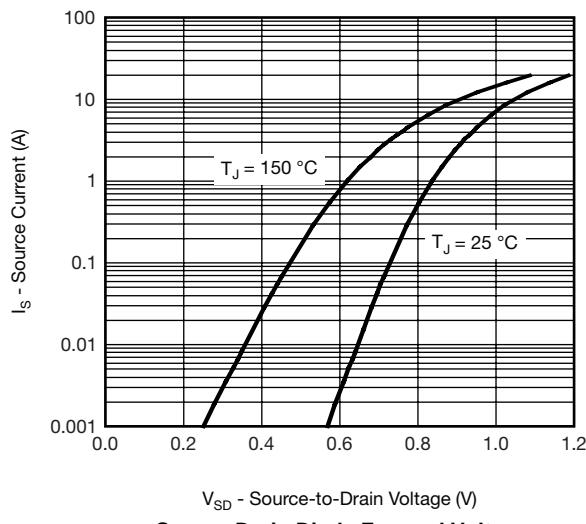


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Ambient

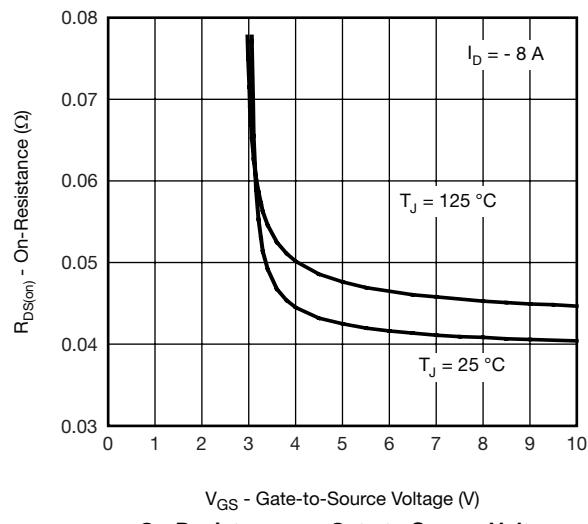
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



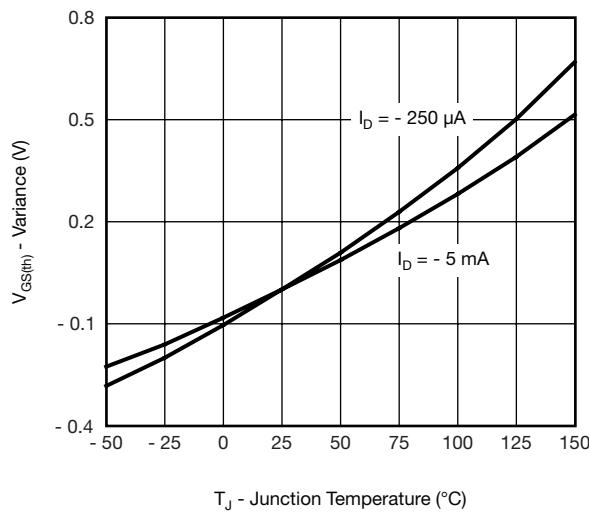
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



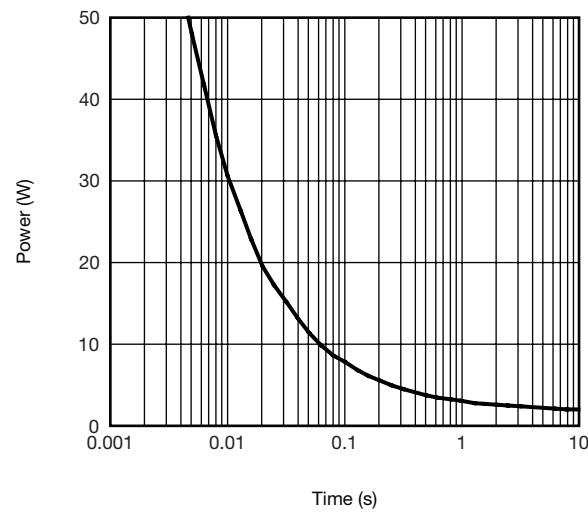
Source-Drain Diode Forward Voltage



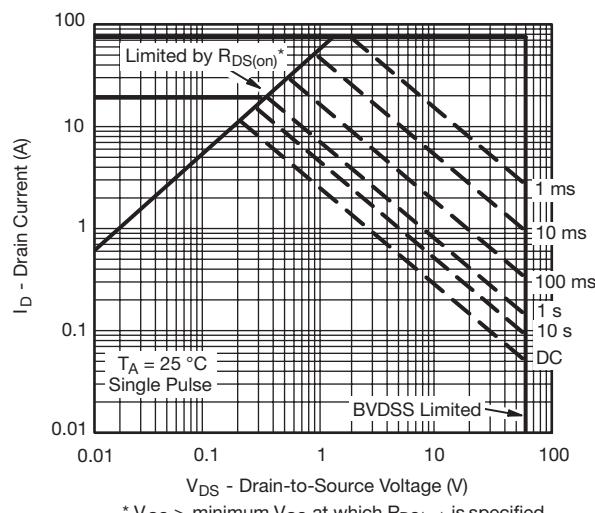
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Ambient

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